

IN THE CLAIMS

1. (Currently amended) A method of manufacturing a semiconductor device comprising:

forming a tungsten layer pattern having an oxidized surface on a substrate;

introducing a source gas including silicon into the oxidized surface of the tungsten layer pattern to form a protecting layer that prevents an abnormal growth of oxide contained in the oxidized surface of the tungsten layer ~~pattern; and pattern, wherein introducing the source gas to form the protecting layer includes~~

applying energy to the source gas to form silicon ions, and

implanting the silicon ions to the oxidized surface of the tungsten layer pattern;

and

thermally treating the substrate.

2. (Original) The method of claim 1, further comprising forming a tungsten oxide layer on the oxidized surface of the tungsten layer pattern.

3. (Original) The method of claim 2, wherein the tungsten oxide layer is formed by a thermal process.

4. (Original) The method of claim 1, wherein forming the protecting layer comprises:

maintaining a temperature of the substrate including the tungsten layer pattern in a range of about 300°C to about 600°C; and

introducing a silane gas onto the oxidized surface of the tungsten layer pattern at a flow rate of about 10sccm to about 1,000sccm to react with the oxidized surface of the tungsten layer pattern.

5. (Original) The method of claim 1, wherein the substrate is thermally treated at a temperature of about 300°C to about 1,100°C.

6. (Original) The method of claim 1, wherein the protecting layer has a thickness of about 1Å to about 100Å.

7. (Cancelled)

8. (Currently amended) A method of manufacturing a semiconductor device comprising:

forming a photoresist pattern on a tungsten layer that is formed on a substrate;

selectively etching the tungsten layer using the photoresist pattern as an etching mask to form a tungsten layer pattern on the substrate;

removing the photoresist pattern;

introducing a source gas ~~including silicon~~ onto a surface of the tungsten layer pattern to form a protecting layer that prevents an abnormal growth of oxide; pattern, the source gas including silicon;

applying energy to the source gas to form silicon ions;

implanting the silicon ions into the surface of the tungsten layer pattern to form a protecting layer that prevents an abnormal growth of oxide; and

thermally treating the substrate.

9. (Original) The method of claim 8, wherein the photoresist pattern is removed by an ashing process and a stripping process.

10. (Original) The method of claim 8, wherein forming the protecting layer further comprises:

maintaining a temperature of the substrate including the tungsten layer pattern in a range of about 300°C to about 600°C; and

introducing a silane gas onto the tungsten layer pattern at a flow rate of about 10 sccm to about 1,000 sccm to react the silicon with the tungsten layer pattern.

11. (Original) The method of claim 8, wherein the substrate is thermally treated at a temperature of about 300°C to about 1,100°C.

12. (Original) The method of claim 8, wherein the protecting layer has a thickness of about 1Å to about 100Å.

13. (Original) The method of claim 8, further comprising an insulating layer formed on the substrate including the tungsten layer pattern.

14. (New) A method of manufacturing a semiconductor device comprising:
a step for forming a tungsten layer pattern having an oxidized surface on a substrate;
a step for forming a protecting layer on the oxidized surface of the tungsten layer pattern that prevents an abnormal growth of oxide, the step for forming the protecting layer including introducing a source gas including silicon on the oxidized surface of the tungsten layer pattern;
and
a step for thermally treating the substrate.

15. (New) The method of claim 14, further comprising a step for forming a tungsten oxide layer on the oxidized surface of the tungsten layer pattern.

16. (New) The method of claim 15, wherein the step for forming the tungsten oxide layer comprises a thermal process.

17. (New) The method of claim 14, wherein the step for forming the protecting layer comprises:

a step for maintaining a temperature of the substrate including the tungsten layer pattern in a range of about 300°C to about 600°C; and

a step for introducing a silane gas onto the oxidized surface of the tungsten layer pattern at a flow rate of about 10 sccm to about 1,000 sccm.

18. (New) The method of claim 14, wherein the step for forming the tungsten layer pattern comprises thermally treating the substrate at a temperature of about 300° C to about 1,100° C.

19. (New) The method of claim 14, wherein the step for forming the protecting layer comprises forming the protecting layer to a thickness of about 1Å to about 100Å.

20. (New) The method of claim 14, wherein the step for forming the protecting layer further comprises:

a step for applying energy to the source gas to form silicon ions; and

a step for implanting the silicon ions to the oxidized surface of the tungsten layer pattern.

REMARKS

Claims 1 and 8 are amended. Claim 7 is cancelled. Claims 14-20 are new. No new subject matter is added. Claims 1-6 and 8-20 are now pending in the application. Reconsideration and allowance of the pending claims is requested in light of the following remarks.

Allowable Subject Matter

Claim 7 is objected to as being dependent upon a rejected base claim, but is otherwise indicated to be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claim.

In keeping with this suggestion, claim 1 is amended to incorporate the subject matter of claim 7. Claim 7 is cancelled.

In the Claims

The amendment of claim 8 is fully supported by the original application at, e.g., claim 7. New claims 14-20 are fully supported by the original application at, e.g., original claims 1-7.

Claim Rejections – 35 U.S.C. § 103

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,893,980 to Akasaka et al. (“Akasaka”). The applicant disagrees.

Claim 1 is amended to incorporate allowable subject matter, as indicated above. Claims 2-6 are allowable at least because any claim that depends from a nonobvious independent claim is also nonobvious. MPEP 2143.03.

Claims 8-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Applicant's Prior Art (APA) in view of Akasaka. The applicant disagrees.

Contrary to amended claim 8, it was indicated that the prior art of record fails to disclose implanting silicon ions to oxidized surface of the tungsten layer.

For this reason, the combination of APA and Akasaka fail to establish *prima facie* obviousness for claim 8 because the references fail to teach or suggest all the features recited in the claim. MPEP 2143.03.

Claims 9-13 are allowable over the combination of APA and Akasaka at least because any claim that depends from a nonobvious independent claim is also nonobvious. MPEP 2143.03.

New Claims 14-20

Independent claim 14 is based upon original claim 1, but is written using terms that fall within 35 U.S.C. 112, 6th paragraph. MPEP 2181.

Consequently, the functional recitation of "to prevent an abnormal growth of oxide ...," which was recognized by the Office Action as not being disclosed by Akasaka but was nevertheless not given patentable weight in claim 1, is present and effective in claim 14.

Because claim 1 is a method claim, rather than an apparatus claim, the Office Action's discussion of the use of the word "means" with respect to the *In re Fuller* case (1929 CD 172, 388 O.G. 279) is not necessarily definitive as to whether or not claim 14 falls within 35 USC 112, 6th paragraph.

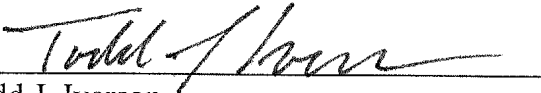
For the above reason, claims 14-20 are allowable over the prior art of record.

Conclusion

For the reasons presented above, reconsideration and allowance of the pending claims is requested. Please telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

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